

# Sustainable mobility in urban areas of midsized municipalities

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*Abstract:* Conventionally, midsized cities in Portugal, as well as in other European countries, are characterized by higher densities of population and households in relation to its surroundings, mainly at the municipality level. On the other hand, the city itself is concentrated in a small urban agglomerate where most of the health, educational, financial and administrative facilities are located, resulting in major traffic generators and central active points of a regional coverage. Land use and mobility planning represents a key issue to achieve a more sustainable urban transportation system. For that, sustainable mobility plans can be considered the first tool towards action. These plans can be formally divided in three phases: the diagnosis of the current situation, the definition of the objectives and concept of intervention in terms of mobility, and the development of proposals for intervention. In order to describe the planning process framework, several proposals were developed in municipal sustainable mobility plans for four different types of urban agglomerates of midsized cities in Northern Portugal, namely in the town of Póvoa de Lanhoso.

*Key-Words:* sustainable mobility, urban planning, bus stops, public transport

## 1 Introduction

Mobility has an important impact on the overall functioning of cities and quality of life of citizens. On the other hand, motorized road traffic is associated with high levels of noise and air pollutant emissions along with congestion and other externalities, leading to considerable social and environmental costs and degradation of human health, causing less healthy and consequently less sustainable urban environments. Therefore, more sustainable transport modes such as walking and cycling are envisaged, as well as the improvement on public transport performance.

Conventionally, midsized cities in Portugal and other European countries area characterized for presenting a higher densities of population and households in relation to its surroundings, mainly in terms of municipality scale. On the other hand, the city itself is concentrated in a small urban agglomerate where most of the health, educational, financial and administrative equipments are located, resulting in major traffic generators and central active points of a regional coverage.

Land use and mobility planning represent a key issue to achieve a more sustainable urban transportation system. For that, sustainable mobility plans can be considered as the first tool in order to action. These plans can be formally divided in three phases: the diagnosis of the current situation, the

definition of the objectives and concept of intervention in terms of mobility, and lastly the development of proposals for intervention.

The diagnosis of the current situation can be made through supply/demand analysis of urban mobility system, as well as with the identification of the major mobility constraints for different modes of transport inherent to the functioning of the various subsystems of the overall transport system.

To integrate the sustainability principles on mobility proposals, it is necessary to characterize and define the main objectives of future interventions as well as the level of priority. At this stage, the introduction of the strategic vision of the authorities responsible for the management of the city transportation system represents an important input for planning as well as its underlying commitment to the achieved solutions.

In order to present the planning process framework, several proposals were produced for four different types of urban agglomerates of some northern Portuguese midsized cities, namely Viana do Castelo, Barcelos, Póvoa de Lanhoso e Arcos de Valdevez.

Several priority actions were identified and detailed proposals were developed for these areas that included the reorganization of land use in the central area of some cities, thus supporting walking and cycling, representing an innovative concept of urban transformation of historical and cultural areas

of interest to promote economic vitality of those areas. The integration of a multimodal approach in bigger cities and the development of air quality monitoring systems are among other solutions to promote the sustainability of these cities. This paper will focus on the case study example of the municipality of Póvoa do Lanhoso.

## 2 Urban sustainable mobility

Transportation systems of mid-sized cities have an important role in guaranteeing a sustainable development of the city and, in a broader sense, of the whole region, since the system is open and interacts with other cities, as well as with the surrounding rural areas. In this paper, the management of an urban transportation system will be presented and discussed, considering its major urban district and the entire city area.

The concept of sustainability has a vast diversity of interpretations and applications and for that reason there is some difficulty in obtaining a practical definition. This concept was primarily formulated by the World Commission on Environment and Development (Brundtland), who defined sustainable development as “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” [1].

As a methodological guide, the ten “Bellagio Principles” [2] have been proposed to assess progress towards sustainable development. These principles were selected by a group of practitioners and researchers from five continents, and served as guidelines for an assessment process including the choice and design of indicators, their interpretation and the communication of the results.

Some of the key characteristics of urban sustainability often mentioned in the literature and in policy documents are, among others [3]:

- intergenerational equity (including social, geographical and governance);
- protection of the natural environment (and living within its carrying capacity);
- minimal use of non-renewable resources;
- economic vitality and diversity;
- community self-reliance;
- individual well-being; and
- satisfaction of basic human needs.

The application of sustainability principles on the management and planning of urban mobility, the integration of different visions and expectations of all stakeholders must take into account the definition of strategies and actions that may

influence the performance of the entire transportation system of a city.

Sustainable mobility should always incorporate intrinsic aspects of mobility and social, economic and environmental aspects, which configures a complex situation to be characterized and explored. According to Erl and Feber [4], to achieve sustainable mobility it is necessary to improve accessibility and use of urban public space, increase the use of active modes of transportation (cycling and walking), reduce traffic congestion, improve safety, reduce air pollution, noise and visual nuisance while developing and maintaining a wealthy and healthy urban economy and ensuring social equity and transport opportunities for all community sectors.

## 3 Planning process framework to achieve sustainable mobility proposals

The planning process to promote a more sustainable mobility is based on the main guidelines recommended by the Portuguese Environmental Agency for the development of sustainable mobility plans for 44 Portuguese municipalities in the year 2007/08, which can be expressed in the following diagram of Figure 1 [5].

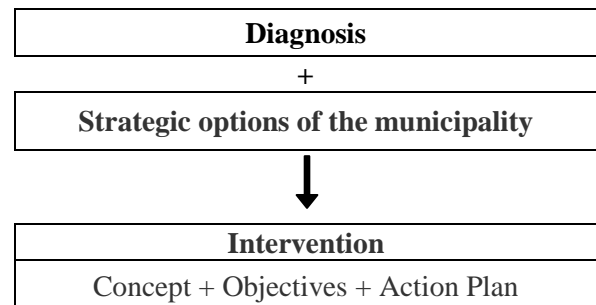


Fig. 1: Conceptual scheme of the methodology of intervention

The diagnosis of the existing situation of an urban transportation system should be focused on the identification of the principal issues that constrain the achievement of a more efficient and sustainable mobility in urban agglomerates, considering space and time dimensions. The assessment of the urban mobility standards are mainly related with the level of adequacy between demand and supply, the modal share, as well as the environmental externalities mainly in terms of noise and air pollution, and lastly the socio-economic impact like road safety and citizens well-being.

The adequacy between transportation demand and supply is based on the characterization of the

places and periods not, or inadequately, served in relation to its potential demand, specifically for public transports, traffic congestion, lack of parking places on streets and parks, road safety black-spots, accessibility for disabled people, and finally physical constraints that all modes of transport could experience, particularly the most sustainable modes.

In the diagnosis stage it is possible to identify and select the priority fields of intervention in the urban transportation system with different schedules for action, since these depend on the type of problem, the mobility constraints and the strategic vision of local authorities. The integration of the aims and visions of the stakeholders plays an important input to achieve participation towards better mobility solutions for all.

Thus, it is important to identify the main objectives and priority actions to be developed to achieve a more sustainable mobility, having as a background the issues and target areas identified in the diagnosis stage. According to Mendes et al [5] five urban domains should always be incorporated in the definition of the objectives and the concept of intervention, which are: the accessibility to workplaces, schools, business and services; parking; allocation of public space to different functions and modes of transport; environmental quality (air pollution and noise) and trip safety (residential areas and schools).

All actions of the proposed interventions should be scheduled with the allocation of the necessary resources and costs, as well as the players and entities involved in the implementation of the proposals.

After the diagnosis of the existing situation and the formulation of the concept and objectives of intervention, it is possible to define a set of proposals that envisage the improvement of mobility and accessibility conditions that should focus on the circulation of all modes and on issues of planning and urban management. Proposals for intervention in urban mobility to achieve higher standards of sustainability need to incorporate the promotion of an active mobility and the use of public transports in urban areas for commuting, which should be combined with the application of several traffic control measures in historical centers and sensitive areas, as the improvement of junction performance, especially in terms of safety for pedestrians and cyclists and the allocation of urban space for different modes of transportation according to street

functioning and with its place on the road/ street hierarchy.

## 4 Case study of the Póvoa de Lanhoso

### 4.1 Diagnosis of the existing situation

The analysis of mobility in the municipality of Póvoa de Lanhoso focused on its main urban center (PU) located in the geographical center of the municipality, comprising the parishes of Vilela, Lanhoso and Póvoa de Lanhoso, which represent an area of approximately 5 km<sup>2</sup> of the total area of the municipality of about 132 km<sup>2</sup> comprising 29 parishes, as illustrated in Figure 2.

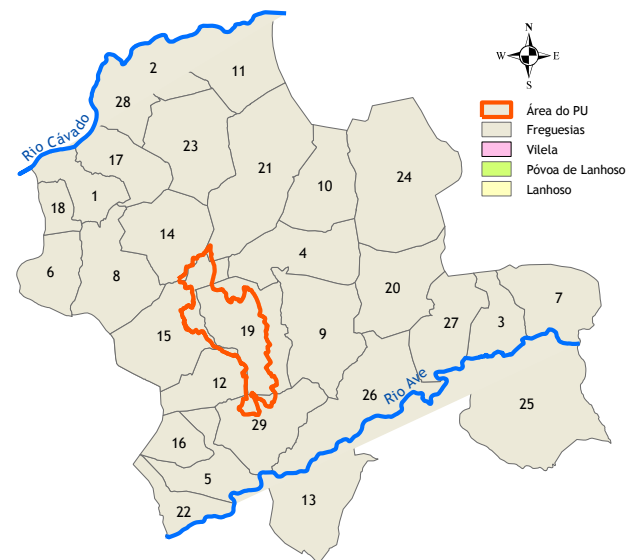


Fig. 2: Definition of the case study area (PU) [6]

The demand and supply analysis was based on the study of the structural and functional conditions of the various subsystems of the overall urban transportation system, relating to different modes of transport through the characterization of the urban road/street network in the municipality and its public transport network, the parking system, as well as the identification of the main walking and cycling infrastructures.

#### 4.1.1 Road network diagnosis

Considering the role that streets play in the overall road network and transportation system and on physical characteristics, the urban network is constituted by three types of roads (Fig. 3):

- Distributors Main Streets (level I and level II);
- Streets Local Distributors;
- Local Access Streets.

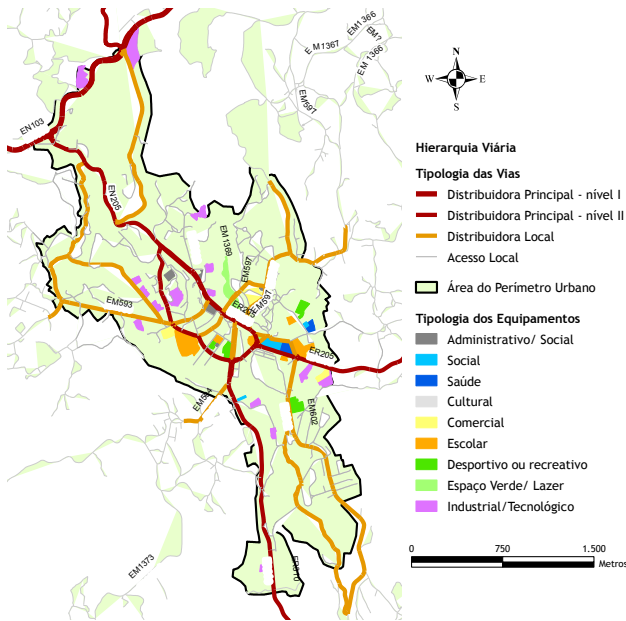


Fig. 3: Functional classification of roads in PU [6]

The primary network that serves and crosses the case study area consists of a set of National (EN) and Regional (ER) roads that simultaneously are the most important streets of the village, namely the Avenida da República that coincides with road EN205, rising conflicts between through-traffic and local traffic and among motorized traffic and walking, cycling and living activities.

Parking is an important component of any transportation system, which is verified by the fact that the viability and vitality of certain activities depends largely on the availability of the existing supply, mainly for commercial purposes. Given the size of the urban area, there are only two streets with paid parking, which are located next to the main administrative equipments of the village, representing less than 100 parking places, in order to promote rotation on these locations. It is possible to conclude that there are no problems with parking supply either on the streets or in car parks. However, some street parking hinders the movement of car traffic, as demonstrated in Fig. 4.



Fig. 4: Legal on-street parking reducing the width for car circulation [6]

#### 4.1.2 Public transport diagnosis

Regarding public transport in the study area, it was concluded that bus routes have very similar input and output in the village. According to the location of existing bus stops, it is possible to conclude that these cover the entire study area for walking under 10 minutes (Fig. 5).

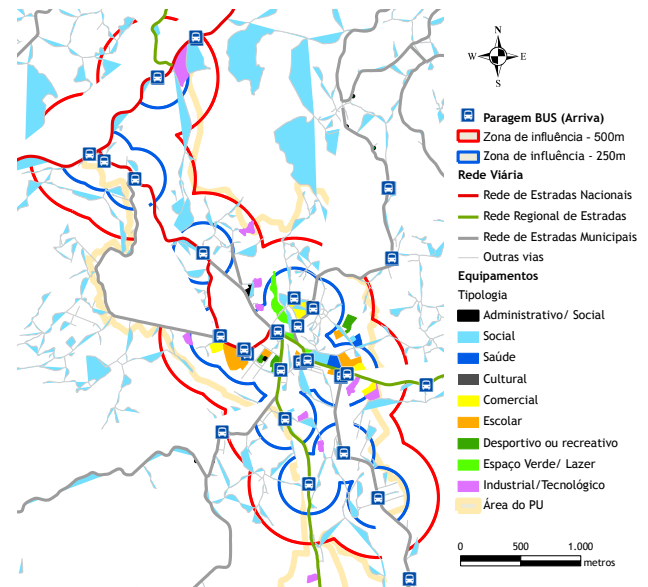


Fig. 5: Bus service coverage in case study area [6]

The bus fleet is dated and rather unpleasant. In addition, the bus stops are not comfortable and poorly secure. The lack of conditions in terms of fleet and bus stops (Fig. 6) is one of the major weaknesses of the transportation system of Póvoa de Lanhoso, clearly identified as a problem to be solved in an attempt to achieve more sustainable urban mobility by promoting use of public transport instead of private cars.



Fig. 6: Example of poor conditions on bus stops near schools [6]

#### 4.1.3 Walking and cycling diagnosis

Pedestrians usually circulate in specific areas, depending on the importance and relative priority that they have in relation to other users of the streets, highlighting the exclusive use of the entire space of the street, particularly in pedestrian streets. In Póvoa do Lanhoso, exclusive pedestrian places



are located only plazas and public gardens, hence pedestrians walk mainly through sidewalks.

In Figure 7 you can see that, in the area bounded by the city limits, the main walking routes are located in the central part of the parish of Póvoa de Lanhoso. From the evaluation of the main pedestrian flows, it was possible to define three hierarchical levels of walking routes: primary, secondary and tertiary, associated mainly to the type and frequency of use.

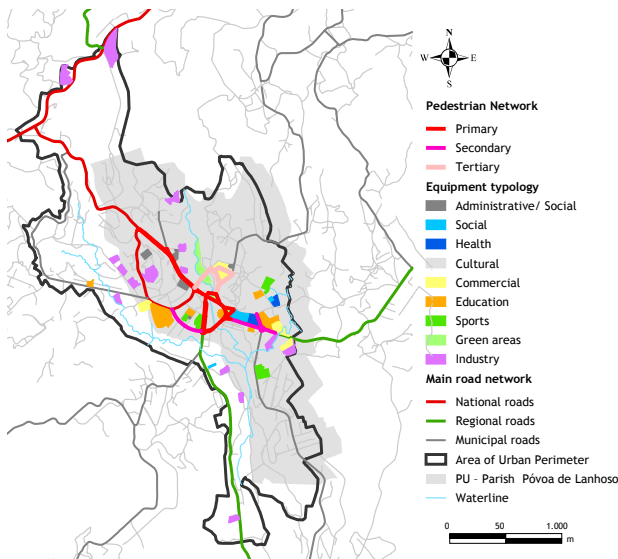


Fig. 7: Main pedestrian routes [6]

The connection between the main facilities located in the urban perimeter provided by the sidewalks network seems to be appropriate; however, some streets cannot guarantee a minimum quality for pedestrian circulation, especially by the presence of obstacles (trees placed in the middle of the sidewalks), forcing pedestrian to risk their own safety by walking on the roadway (Fig. 8). This is even more dangerous considering disabled people.



Fig. 8: Pedestrians forced to walk on roadway [6]

## 4.2 Defining the concept and objectives of intervention

The establishment of intervention targets for a more sustainable urban mobility requires the integration of the strategic vision of the municipal authorities of Póvoa do Lanhoso, that are:

- adopt transport policies associated with the improvement of the mobility and accessibility conditions for pedestrians and users of public transport;
- adopt diverse and innovative solutions for urban mobility, exploring intermodality between conventional modes of transport and soft modes;
- adopt a parking and circulation policy that envisages the sustainable development of the central area of the town, aiming to strengthen the centrality of this area mainly in the socio-economic dimension over the reduction of exposure to through-traffic;
- improve the accessibility and mobility for all users of public space, ensuring the democratization of the use of public spaces and reinforcing the importance of the pedestrian mode for the majority of journeys in the urban area.

The concept and objectives of this intervention should address, in an integrated and complementary approach, issues related to the road network, its hierarchy and legibility, the supply of public transport and multimodal articulation, parking policies and soft (pedestrians and cyclists) travelling. Through the definition of a strategy-diagnosis matrix, it is possible to combine the themes that characterize the mobility system with the strategies recommended by the City Council and define the objectives to achieve a sustainable and participated urban mobility, which were defined as:

- a) Enhancing the use of pedestrian and public transport mode for main commuting purposes;
- b) Protecting the urban center in relation to through-traffic.

Several actions were proposed for interventions, scheduled and quantified costs and assembled the necessary resources.

## 4.3 Defining proposals of intervention

For the study area, three scenarios were studied to improve the problematic bus stops, namely in terms of security and comfort in school areas, as well as the lack of minimum conditions of comfort on the main bus stop located in the town centre.

To resolve this situation, a modular system of bus stops with shelter was developed, in order to introduce acceptable comfort levels during the waiting period and in other cases to ensure minimum security conditions for bus passengers through the relocation of some bus stops. However, the most innovative solution corresponded to the creation of a "Central Outdoor Bus Station", which consisted of an integrated system of several multifunctional bus stops that should be sprawled in the central area, but relatively close so as to work together as a network, to provide complementary services, such as bathrooms, ticket sales, newspaper stand, helpdesk and public attendance. For that, four types of modular bus shelters (Fig. 9) were created, which can be used and aggregated according to the expected range of services.

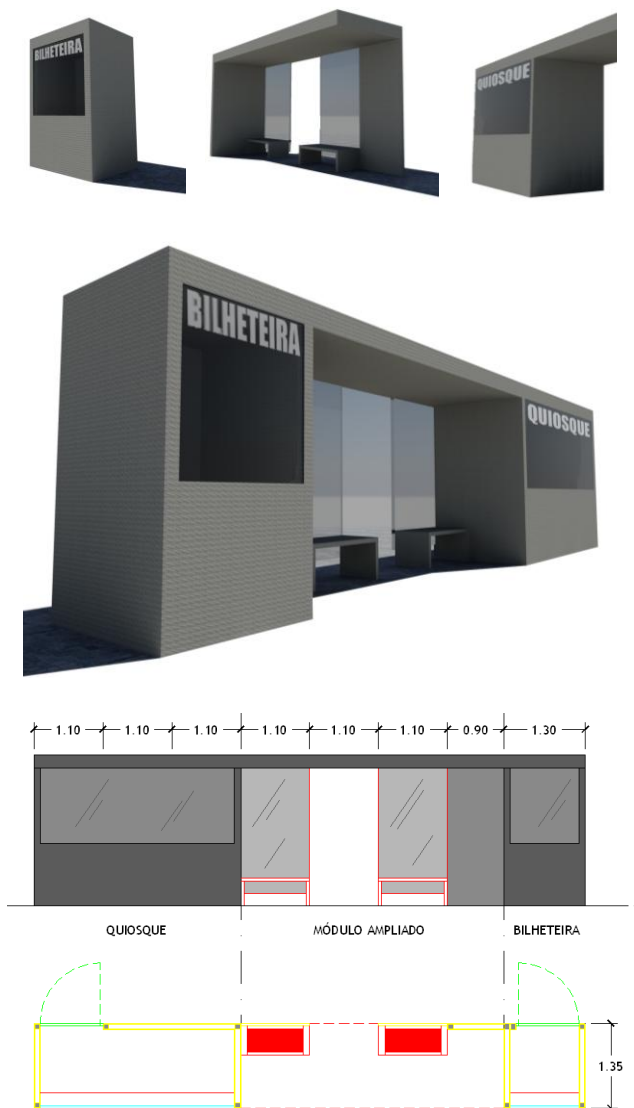


Fig. 9: Detailed proposal for different types of bus stops [7]

## 6 Conclusions

The methodology presented in this paper focused on the development of measures towards achieving a more sustainable urban mobility, leading to a more equitable and globally more sustainable urban environment. This was based on the diagnosis of the existing situation in the urban transportation system and the integration of vision of municipal authorities responsible for planning and transports and other related stakeholders, defining the objectives and actions to be undertaken in future interventions. The aim is to promote the adoption of more structured and targeted processes that result in more useful and effective actions.

In this work, the case study example presented aimed at the improvement of the mobility conditions for more sustainable modes of transport, such as walking and travelling by bus instead of private cars. Among all the actions under study, the priority intervention for the urban area of Póvoa de Lanhoso consisted of the restructuration of the bus stops infrastructure, where a new concept of sprawled central bus station divided by modular shelters was developed.

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